THE PLANT DISEASE REPORTER

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VIRUSES DESCRIBED PRIMARILY ON ORNAMENTAL OR MISCELLANEOUS PLANTS, II

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

VIRUSES DESCRIBED PRIMARILY ON ORNAMENTAL OR MISCELLANEOUS PLANTS, II

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of the Committee on Virus Classification and Nomenclature,
American Phytopathological Society

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This list conforms with the previous compilation of the same title (Plant Disease Reporter Supplement 150; 1944) in purpose and treatment. At the request of the present Chairman of the Committee on Virus Classification and Nomenclature, the scope of the list has been extended to comprise all viruses not specifically assigned to other sub-committees. Twenty-four additional viruses are described here, and supplementary data are added for 10 viruses previously treated.

List of Viruses Described or Supplemented

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ARABIS MOSAIC VIRUS

Technical name:

Synonym:
Arabis mosaic virus Smith & Markham 1944

Name of disease: Arabis mosaic

Geographical distribution: England

Host range:
CRUCIFERAE -- *Arabis hirsuta (L.) Scop. (rock cress).

CUCURBITACEAE -- Cucumis sativus L. (cucumber).

LEGUMINOSAE -- Phaseolus vulgaris L. (Canadian Wonder bean).

SOLANACEAE -- Nicotiana glutinosa L., N. tabacum L. (White Burley tobacco), Solanum nodiflorum ? Jacq.

Symptoms: In A. hirsuta, dark green ring and line patterns with some mottling. In White Burley tobacco, no definite primary lesions; after 10 to 21 days systemic reddish necrosis, shredding and puckering of the central leaves with ring-like necrotic spots elsewhere. In cucumber, mosaic mottling. In Canadian Wonder bean, systemic yellow flecks after 10 days, followed by mottling and necrosis.

Means of transmission: By sap. No vector is known. Difficult to transmit to Arabis.

Properties: Thermal inactivation in 10 minutes at 60° C, survives 10 minutes at 50°. Dilution 1:100 is infective, not 1:1000. Resists aging 48 to 72 hours at room temperature.

Remarks:
The virus was isolated in midwinter from Arabis hirsuta growing in an insect-free glasshouse. Cross-immunity tests indicate no relationship with Brassica virus 1 Smith or with cucumber mosaic virus. Datura stramonium L. is insusceptible.

Literature:

Smith, Kenneth M., and Roy Markham. Two new viruses affecting tobacco and other plants. Phytopath. 34: 324-329. 1944

(CALLISTEPHUS) ASTER YELLOWS VIRUS (supplement)

(See also Plant Disease Reptr. Suppl. 150, p. 418, 1944)

Host range: (additions)

ASCLEPIADACEAE -- *Asclepias syriaca L.

CARYOPHYLLACEAE -- Cerastium vulgatum L., Dianthus armeria L., Silene noctiflora L.

COMPOSITAE -- Anaphalis margaritacea (L.) A Gray

CRUCIFERAE -- Barbarea vulgaris R.Br., Berteroa incana (L.) DC., Erysimum cheiranthoides L., Lepidium virginicum L.,Sisymbrium officinale (L.) Scop.

DIPSACACEAE -- Dipsacus sylvestris Huds.

LABIATAE -- Lamium purpureum L., Leonurus cardiaca L., Prunella vulgaris L.

MALVACEAE -- Malva moschata L.

PLANTAGINACEAE -- *Plantago rugelii Dcne.

POLYGONACEAE -- Polygonum convolvulus L.

PORTULACACEAE -- Portulaca oleracea L.

ROSACEAE -- Geum strictum Ait.

SCROPHULARIACEAE -- Verbascum blattaria L., V. thapsus L.

SOLANACEAE -- Nicotiana glutinosa L. [Epps 1942].

Remarks:

Epps (1942, 1943), as well as Younkin (1943) and Leach & Bishop (1944), produced potato purple-top wilt with aster yellows virus. Chrysanthemum leucanthemum L., and Plantago major L. are considered the chief overwintering reservoirs of this virus in New York. McKinney (1944) emends the genus Chlorogenus and the species C. callistephi.

Literature:

Epps, W. M. Purple-top wilt of potatoes. Thesis, Cornell Univ. 1942. 54 pp. (unpublished).

_____ Purple-top wilt of potatoes. Cornell Univ. Abstracts of Theses 1942: 363-365. 1943.

Leach, J. G., and C. F. Bishop. Further studies on the nature and cause of purple-top wilt of potatoes. (Abst.) Phytopath. 34: 1006-1007. 1944.

McKinney, H. H. Genera of the plant viruses. Jour. Washington Acad. Sci. 34: 139-154. 1944

(CALLISTEPHUS) CALIFORNIA ASTER YELLOWS (supplement)

(See also Plant Disease Reptr. Suppl. 150, p. 423, 1944)

Symptoms: In Phlox drummondii Hook. breaking in flower color as well as virescence and proliferation [Severin 1943].

Literature:

Severin, H. H. P. Breaking in color of flowers of annual Phlox caused by the aster-yellows virus. Phytopath. 33: 741-743. 1943

(CAMELLIA) TEA PHLOEM-NECROSIS VIRUS

Technical name:
Camellia virus 1 Bond 1944

Synonyms:
Tea phloem necrosis (virus) Gadd 1937
Tea phloem necrosis virus Bond 1944

Name of disease: Tea phloem necrosis

Geographical distribution: Ceylon.

Host range:
TERNSTROEMIACEAE -- *Camellia sinensis (L.)Kuntze

Symptoms: Phloem necrosis in roots, stems, and leaves, appearing as small yellow or yellow-brown specks in early stages and as darker-colored spots in advanced stages. Zigzag growth of stems, curling of leaves, and dwarfing of shoots are inconstant attendant symptoms. Severely affected bushes are entirely unproductive. [Gadd 1939a, Bond 1942, 1944].

Means of transmission: By grafting, symptoms appearing after 5 months or longer [Bond 1942, 1944]. Not by sap [Gadd 1938]. Not through seed [Bond 1942].

Properties: Not determined.

Remarks:
Diagnosis of phloem necrosis is difficult, for external symptoms are erratic in expression, and roots or petioles must be examined for necrotic effects. Tea is difficult to graft, and early transmission trials were made with "high jât" stocks that later proved to be symptomless carriers. Although "high jât" teas seem to be carriers in general, and "low jât" susceptible, exceptions may be expected [Bond 1944].

Literature:

Bond, T. E. T. Report of the assistant mycologist for the year 1940. Bul. Tea Res. Inst. Ceylon 22, pp. 39-42. 1941. (Not seen)

_____ Phloem necrosis. In Gadd, C. H. Report of the mycologist for 1941. Bul. Tea Res. Inst. Ceylon 23, pp. 34-42. (1942 ?).

_____ The 'phloem necrosis' virus disease of tea in Ceylon I. Introductory account, symptoms and transmission by grafting. Ann. Appl. Biol. 31: 40-47. 1944

Gadd, C. H. Report of the mycologist for 1936. Bul. Tea Res. Inst. Ceylon 17, pp. 23-30, 1937. (See p. 27-28).

_____ Report of the mycologist for 1937. Bul. Tea Res. Inst. Ceylon 18, pp. 20-27, 1938. (See p. 22-24).

_____ Disease in non-productive bushes. Tea Quarterly (Ceylon) 12: 75-83. 1939a

_____ Report of the mycologist for 1938. Bul. Tea Res. Inst. Ceylon 19, pp. 27-33. 1939b. (See p. 29-30).

(CANNABIS) HEMP STREAK VIRUS

Technical name:

Synonyms:
Hanf Streifen (hemp streak) virus Röder 1941

Name of disease: Hemp streak

Geographical distribution: Germany

Host range:
MORACEAE -- * Cannabis sativa L.

Symptoms: "Primary" symptoms, pale green interveinal chlorosis and marked curling, long confined to the bases of the young leaves. Secondary ("folge Symptom"), brown necrotic flecks near the margins and tips of older leaves, later enlarging and coalescing to include the whole interveinal area, the veins long remaining green. Finally the tips and margins roll upward until the leaflets are spirally curled. Plants are much dwarfed, with reduced yield of fiber and seed.

Means of transmission: By sap, chlorotic symptoms appearing after 6 days, occasionally followed by necrotic spotting but no leaf roll. Through seed, 27% of seedlings showing symptoms in the third to fifth pair of leaves and later.

Properties: Not determined.

Remarks:
Sap inoculation from chlorotic and necrotic diseased plants produces like symptoms of the chlorotic type. Both types of symptoms are therefore held to be produced by the same virus. In the field the chlorotic symptoms are seen chiefly during moist weather, the necrotic during dry weather.

In seed transmission, about twice as many female as male seedlings develop symptoms.

Literature:

Röder, K. Einige Untersuchungen über ein an Hanf (Cannabis sativa L.) auftretendes Virus. Faserforschung 15: 77-81. 1941

(CARICA) PAPAYA MOSAIC VIRUS

Technical name:

Synonyms:
Papaw (mosaic) virus (?) Smith 1929
Papaw curly-leaf (virus) Ciferri 1930
Papaw yellow crinkle (virus ?) Morwood 1931
Papaya bunchy top (virus ?) Cook 1931a, Jensen 1938
Papaya (mosaic) virus Parris 1938

Name of disease: Papaya mosaic

Geographical distribution: Burma [Su 1934], Brasil [Gonçalves-Silva 1941], Kwangtung, China [Tu 1932], East Indies [Rant 1931], Hawaii [Parris 1938], Queensland, Australia [Morwood 1931], Rhodesia [Hopkins 1940], Venezuela [Müller 1941], Jamaica [Smith 1929], Puerto Rico [Cook 1931], Santo Domingo [Ciferri 1930], Trinidad [Baker 1939].

Host range:

CARICACEAE -- *Carica papaya L.

Symptoms: Plants are stunted, leaves are yellowed, crinkled, and bend downward and inward, petioles bend downward. Diseased leaves abscise leaving a few dwarfed and distorted leaves at the top of the stem. Linear dark green streaks appear on stems and petioles [Parris 1938]. Symptoms are variable: typically watersoaked areas appear on stems and petioles, and a marked mosaic in young leaves. Older leaves are unaffected until the die-back stage, some 8 or 9 weeks after first symptoms, when stem tips commonly die back 1 or 2 feet [Baker 1939]. See also: Ciferri (1930), Ho & Li (1936), Jensen (1938), Simmonds (1938).

Means of transmission: By sap, symptoms appearing after 16 to 21 days [Parris 1938], but sap transfer failed in tests reported by Jensen 1938, Simmonds 1938, Alvarez 1941. Ciferri 1930 claimed transfer by latex inoculation. Not by budding [Jensen 1938]; not by grafting [Parris 1938, Baker 1939]. Infected buds and scions usually die without uniting. Not through seed [Smith 1929, Alvarez 1941]. No vector is known.

Properties: Not determined.

Remarks:

Evidently two or more viruses or strains of one virus are concerned in the mosaic and die-back of papaya. Baker distinguishes the severe type present in Jamaica [Smith 1929], Santo Domingo [Ciferri 1930], Java [Rant 1931], and Trinidad [Baker 1939], and a milder type, lacking the sudden dieback symptom, in Santo Domingo [Ciferri 1930], Puerto Rico [Cook 1931b, Jensen 1938, 1939], Queensland [Morwood 1931, Simmonds 1938], and Kwangtung [Ho & Li 1936]. The papaya mosaic of Hawaii [Parris 1938], the only type clearly demonstrated to be transmissible, is of the mild class. Natural recovery is recorded for both types [Jensen 1938, Baker 1939] and in each type the virus seems to move downward slowly so that topping recently infected plants often effects a cure [Smith 1932, Jensen 1938, Parris 1938, Baker 1939, Serrano 1940].

Literature:

Alvarez, L. A. Studies on the virus disease complex in the papaya. Ann. Rep. Puerto Rico Agric. Exp. Sta. Rio Piedras 1940-1941. 71 pp. 1941. (See p. 62).

Baker, R. E. D. Papaw mosaic disease. Trop. Agriculture (Trinidad) 16: 159-163. 1939

Ciferri, R. Phytopathological survey of Santo Domingo 1925-1929. Jour. Dept. Agr. Porto Rico 14: 5-44. 1930. (See p. 31-32).

Cook, M. T. New virus diseases in Porto Rico.(Abst.). Phytopath. 21: 124. 1931a

_____ New virus diseases of plants in Porto Rico. Jour. Dept. Agr. Porto Rico 15: 193-195. 1931b.

Da Costa, E. W. B. Diseases of the papaw. Queensland Agric. Jour. 58: 282-293. 1944

Gonçalves-Silva, S. Doenças do mamoeiro. Biologico 7: 220-225. 1941.

Ho, W. T. H., and L. Y. Li. A virus disease of papaya (Carica papaya L.). In Preliminary notes on the virus diseases of some economic plants in Kwangtung Province. Lingnan Sci. Jour. 15: 67-68. 1936.

Hopkins, J. C. F. Annual report of the Senior Plant Pathlogist for the year ending 31st December, 1939. Rhodesia Agric. Jour. 37: 411-423. 1940. (See p. 412).

[Jensen, J. H.]. Studies of papaya bunchy top. In Report Puerto Rico Exp. Sta. Mayaguez 1937, 115 pp. 1938. (See p. 82-87).

_____ Plant disease investigations. In Report Puerto Rico Exp. Sta. Mayaguez 1938, 137 pp. 1939. (See p. 121-129).

Morwood, R. B. The work of the pathological branch. Ann. Rep. Queensland Dept. Agr. & Stock 1930-1931: 47-48. 1931.

Müller, A. S. El reconocimiento de las enfermedades de las plantas cultivades en Venezuela, 1937-1941. Bol. Soc. Venez. Cien. Nat. 7: 99-113. 1941. (See p. 106).

Parris, G. K. A new disease of papaya in Hawaii. Proc. Amer. Soc. Hort. Sci. 36: 263-265. 1938

Rant, A. Über eine Bakterienkrankheit bei dem Melonenbaume (Carica Papaya Linn.) auf Java. Zentralbl. Bakt. II, 84: 481-487. 1931

Serrano, L. A. Papaya. In Ann. Rep. Univ. Puerto Rico Agr. Exp. Sta. (Rio Piedras) 1939-1940. 66 pp. (1940 ?) (See p. 55).

Simmonds, J. H. Plant diseases and their control. Queensland Agric. & Pastoral Handbook, Vol. III, Part II, p. 117-254, Brisbane, 1938. (See p. 186-188).

Smith, F. E. V. Plant diseases in Jamaica in 1928. Ann. Rep. Dept. Agr. Jamaica 1928: 17-20. 1929

_____ Plant diseases in Jamaica in 1931. Ann. Rep. Dept. Agr. Jamaica 1931: 17-20. 1932.

Su, M. T. Report of the mycologist, Burma, Mandalay, for the year ending 31st March, 1934. Rept. Dept. Agr. Burma, 1933-34, pp. 25-33. 1934.

Tu, C. Notes on some diseases of economic plants in South China. Lingnan Sci. Jour. (Canton) 11: 490-491. 1932

CUSCUTA LATENT VIRUS

Technical names:

Marmor secretum Bennett 1944
Cuscuta virus 1 Bennett 1944
Cuscutavir secretum Bennett 1944

Synonyms:
Dodder latent mosaic virus Bennett 1944
Cuscuta latent virus (this list)

Name of disease: Dodder latent mosaic

Geographical distribution: United States (California).

Host range:

CONVOLVULACEAE -- *Cuscuta californica Choisy
C. campestris Yuncker, C. subinclusa Dur. & Hilg.

CHENOPODIACEAE -- Beta vulgaris L. (sugar beet), Chenopodium album L., C. murale L.

CRUCIFERAE -- Brassica incana (L.) F. W. Schultz [B. geniculata (Desf.) J. Ball] (symptomless).

CUCURBITACEAE -- Cucumis melo L. (Rocky Ford cantaloup).

PHYTOLACCACEAE -- Phytolacca americana L.

PLANTAGINACEAE -- Plantago major L.

POLYGONACEAE -- Fagopyrum esculentum Moench. (buckwheat), Polygonum pensylvanicum L.

PRIMULACEAE -- Samolus floribundus H.B.K.

SOLANACEAE -- Lycopersicon esculentum Mill. (tomato), Nicotiana glauca Graham (symptomless), N. palmeri Gray, N. rustica L. (symptomless), N. tabacum L. (symptomless), Solanum tuberosum L. (White Rose potato).

UMBELLIFERAE -- Apium graveolens L. (celery).

Symptoms: In Cuscuta spp., none. In sugar beet, systemic yellow leaf spotting, followed by mottling, and masking after 6 to 8 leaves are produced. In Rocky Ford cantaloup, systemic yellow spotting, curling, and dwarfing of leaves, dwarfing of vines and fruits. In White Rose potato, systemic dark necrotic spotting, followed by mottling, with masking on further growth. In tomato, watersoaked leaf spots after 7 to 14 days, followed by mottling, and finally by masking. In celery, golden yellow chlorosis, then mottling with crinkling and dwarfing of leaves, followed by masking. In pokeweed, necrotic primary lesions after 3 to 4 days, followed by a zone of systemic necrosis, with masking in later stages of growth.

Means of transmission: By sap to pokeweed, sugar beet, Chenopodium murale, and Cuscuta campestris. By dodder (Cuscuta californica, C. campestris, C. subinclusa). Transmitted through seed of Cuscuta campestris only, of the species tested for seed transmission. No vector is known.

Properties: (determined in pokeweed). Thermal inactivation between 56° and 60° C. Withstands aging at room temperature 48 hours, not 72 hours. Infectious at dilution 1:3000, not at 1:5000. Retains acti-

vity in dried juice of pokeweed less than 48 hours. Passes Berkefeld N and W filters or 1/2-inch layer of Celite without loss of infectivity.

Remarks:
This virus was collected in Cuscuta californica growing on desert plants immune to infection. The experimental host range as determined by dodder transfer is much wider than the range determined by sap inoculation. Symptoms disappear in later stages of growth in many hosts.

Literature:
Bennett, C. W. Latent virus of dodder and its effect on sugar beet and other plants. Phytopath. 34: 77-91. 1944

DAHLIA MOSAIC VIRUS (supplement)

(See also Plant Disease Reptr. Supplement 150, p. 428, 1944).

Geographical distribution: Denmark, Sweden.

Literature:
Lihnell, D. Hur se edra Dahlior ut? Växtskyddsnotiser, Växtskyddsanst., Stockholm 7 (4): 3-5. 1943. (RAM 22: 482. 1943).

(DIANTHUS) CARNATION MOSAIC VIRUS (revision)

Technical name:

Synonyms:
Carnation yellows (virus) Peltier 1916 (in part)
Carnation yellows (virus) Jones 1940 (in part)
Carnation mosaic virus Creager 1943 (in part)
Carnation mosaic virus Jones 1945

Name of disease: Carnation mosaic

Geographical distribution: England [Smith 1937], Japan [Asuyama 1938, Fukushi 1932], United States.

Host range:
CARYOPHYLLACEAE -- *Dianthus caryophyllus L.

Symptoms: Slight mottling of leaves with light-green irregular to elongate blotches, usually more pronounced in young leaves. Somewhat lighter streaking in colored flowers [Jones 1945].

Means of transmission: By grafting [Peltier 1916, Jones 1939, 1945, Creager 1943]. By sap [Jones 1939, 1945], symptoms after 22 to 60 days. Not through seed [Jones 1945]. No vector is known; not transmitted by Myzus persicae Sulz. or Thrips tabaci Lind. [Jones 1945].

Properties: Thermal inactivation near 60° C; active after aging 7 days, not after 42 days [Jones 1945].

Remarks:

Carnation mosaic virus is generally distributed in commercial carnations. This virus in combination with carnation streak virus (see below) produces the disease known as carnation yellows, much more destructive but less generally distributed than carnation mosaic [Jones 1945].

Symptoms of yellows are more severe in spring than in fall and winter, and tend to be more severe under conditions unfavorable for growth of carnations. No immunity to yellows is known, but commercial tolerance is available in new seedling varieties [Jones 1945].

Distribution records that cannot be definitely interpreted are assumed to include carnation mosaic virus.

Literature:

Asuyama, H. New diseases and pathogens reported recently on the cultivated plants of Japan IV. Ann. Phytopath. Soc. Japan 7 (3-4): 231-236. 1938. (Japanese) (RAM 17: 506)

Creager, D. B. Carnation mosaic. Phytopath. 33: 823-827. 1943

_____ How to recognize and control mosaic on carnation plants. Flor. Rev. 93 (2409): 27-29. 1944.

_____ Mosaic in carnations reduces the quality and the yield of flowers. Flor. Rev. 94 (2434): 13-14. 1944

Fukushi, T. A contribution to our knowledge of virus diseases of plants in Japan. Trans. Sapporo Nat. Hist. Soc. 12: 30-141. 1932

Jones, L. K. Washington Agric. Exp. Sta. Repts. 48: 65-66. 1938; 49: 61-62. 1939; 50: 76-77. 1940; 51: 85. 1941; 52: 74. 1942; 53: 67. 1943

_____ Mosaic, streak, and yellows of carnation. Phytopath. 35: 37-46. 1945

Lamkey, E. M. R. A consideration of yellows. Proc. Amer. Carnation Soc. 26: 25-35. 1917

Peltier, G. L. Carnation yellows. Proc. Amer. Carnation Soc. 25: 29-35. 1916

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 554

(DIANTHUS) CARNATION STREAK VIRUS

Technical name:

Synonyms:

Carnation yellows complex Jones 1945 (in part).
Carnation streak virus Jones 1945

Name of disease: Carnation streak

Geographical distribution: United States [Jones 1945], probably elsewhere as a constituent of carnation yellows complex.

Host range:

CARYOPHYLLACEAE-- *Dianthus caryophyllus L.

Symptoms: In leaves, spots and streaks 1/2 to 1 mm wide, circular or elongate, parallel to the veins. In varieties with red flowers the leaf spots are reddish, in those with white or pale flowers the spots are yellowish. Lower leaves later wither and die. No distinguishable breaking of flower color [Jones 1945].

Means of transmission: Not by sap. By grafting. By Myzus persicae Sulz., symptoms after 25 to 60 days. Not through seed [Jones 1945].

Properties: Not determined.

Remarks:

Carnation streak virus is not found alone in commercial carnation cultures, but occurs in combination with carnation mosaic virus (see above) in the complex kown as carnation yellows [Jones 1945].

Literature:

Jones, L. K. Mosaic, streak, and yellows of carnation. Phytopath. 35: 37-46. 1945

JUSTICIA VIRESCENCE VIRUS

Technical name:

Synonyms:

Justicia green-flowering virus (?) Su 1933
Justicia virescence virus (this list)

Name of disease: Justicia virescence

Geographical distribution: Burma.

Host range:

ACANTHACEAE -- *Justicia gendarussa L.

Symptoms: Green flowering.

Means of transmission: By grafting.

Remarks:

Su reports this disease similar to the green-flowering of Sesamum indicum, which has not yet been shown to be a virus disease. [See also tobacco virescence virus, e. g., Hill, A. V. Insect transmission and host plants of virescence (big bud of tomato). Austral. Council Sci. & Indus. Res. Jour. 16: 85-90. 1943].

Literature:

Su, M. T. Report of the Mycologist, Burma, Mandalay, for the year ended the 31st March, 1933, 12 pp. 1933

LEVISTICUM MOSAIC VIRUS

Technical name:

Synonyms:
Lovage virus Smith & Markham 1944
Levisticum mosaic virus (this list).

Name of disease: Levisticum mosaic.

Geographical distribution: England.

Host range:
UMBELLIFERAE -- *Levisticum officinale L. (lovage)
CUCURBITACEAE -- Cucumis sativus L. (Ridge cucumber).
CRUCIFERAE -- Arabis hirsuta (L.) Scop. (rockcress).
LEGUMINOSAE -- Phaseolus vulgaris L. (Canadian Wonder bean), Pisum sativum L. (garden pea).
MALVACEAE -- Lavatera trimestris L. (garden mallow).
SOLANACEAE -- Datura stramonium L., Capsicum annuum L., Lycopersicon esculentum Mill. (Kondine Red tomato), Nicotiana glutinosa L., N. langsdorffi Weinm., N. sylvestris Speg., N. tabacum L.

Symptoms: In Levisticum officinale, slight stunting, with bold, somewhat streaky mottling of light and dark green in leaves. In White Burley tobacco, dark red necrotic primary lesions after 7 days, systemic necrosis after 17 days. In Canadian Wonder bean, yellow primary spots after 3 or 4 days followed by necrosis of veins and of the growing point. In Ridge cucumber, slight mosaic mottling, death of the growing point.

Means of transmission: By sap. No vector is known.

Properties; Thermal inactivation 10 minutes at 60° C, survives 10 minutes at 55° C. Dilution 1:100 is infective, not 1:1000. Resists aging about 1 week.

Remarks:
The virus is easily transmitted by sap to most of its host plants, but with great difficulty to Levisticum. Carrot, celery, and potato are insusceptible, tomato a symptomless carrier. Cucumber mosaic virus fails to protect against Levisticum mosaic virus in cucumber.

Literature:

Smith, Kenneth M., and Roy Markham. A virus disease of lovage (Ligusticum scoticum). Phytopath. 34: 335-340. 1944
Errata, Volume XXXIV. Phytopath. 35, No. 1 supplement. 1945

(LILIUM) LILY ROSETTE VIRUS (supplement)

(See Plant Disease Reptr, Supplement 150, p. 449, 1944)

Additions to host range:

LILIACEAE -- Lilium dauricum Ker-Gawl., L. davidi Duchartre, L. davidi var. willmottiae Cotton & Grove., L. elegans Thunb., L. formosanum Stapf., L. henryi Baker, L. leucanthum Baker, L. myriophyllum var. superbum (Baker) Wilson, L. regale Wilson, L. sargentiae Wilson, L. speciosum Thunb., L. umbellatum Hort. [Brierley & Smith]

Literature:

Brierley, Philip, and Floyd F. Smith. Additional species of Lilium susceptible to lily-rosette virus. Phytopath. 35: 129-131. 1945

(MANIHOT) CASSAVA BROWN-STREAK VIRUS

Technical name:
Manihot virus 2 Smith 1937

Synonyms:
Cassava stem-lesion virus Storey 1936a
Cassava brown-streak virus Storey 1936b, 1938, 1940, 1941
Cassava stem lesion virus Holmes 1939

Name of disease: Cassava brown streak

Geographical distribution: East Africa -- Tanganyika [Storey 1936], Zanzibar [Storey 1938].

Host range:

EUPHORBIACEAE -- Manihot spp. (cassava)

Symptoms: Dark brown, circular or elongate lesions in the young stem, persisting as sunken areas when bark develops. Stems may become very brittle and break, particularly at lower temperatures. Yellow mottling of leaves as these approach maturity, not recognizable in young leaves. Brown lesions may appear in tuberous roots [Storey 1936a, b]

Means of transmission: By grafting [Storey 1936a, b]. An insect vector is suspected but not established [Storey 1941].

Properties: Not determined.

Literature:

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 190.
Smith, K. M. A textbook of plant virus diseases. London. 1937. p. 96.

Storey, H. H. Report of the Plant Pathologist. Rep. E. Afr. Agric. Res. Sta. Amani 1935-36, pp. 11-14. 1936a

_____ Virus diseases of East African plants: VI.--A progress report on studies of the disease of cassava. E. Afr. Agric. Journ. 2: 34-39. 1936b

_____ Plant Pathology. Rep. E. Afr. Agric. Exp. Sta. Amani Apr.-Dec. 1937. pp. 9-13. 1938

_____ Plant Pathology. Rep. E. Afr. Agric. Exp. Sta. Amani 1939, pp. 8-11. 1940

_____ Plant Pathology. Rep. E. Afr. Agric. Exp. Sta. Amani 1940, pp. 7-8. 1941

(MANIHOT) CASSAVA MOSAIC VIRUS

Technical names:
Manihot virus 1 Smith 1937
Ruga bemisiae Holmes 1939
Ochrosticta bemisiae (Holmes) McKinney 1944

Synonyms:
Kräuselkrankheit des Maniok (virus) Warburg 1894
Kräuselkrankheit des Maniok virus Zimmermann 1906
Cassava mosaic (virus) Deighton 1927
Mosaïque du manioc (virus) Dufrénoy & Hédin 1929
Cassava curly-leaf virus Storey 1930
Mandioca mosaic (virus) Strong & Shattuck 1930
Cassava mosaic virus Storey & Nichols 1938

Name of disease: Cassava mosaic

Geographical distribution: Western and Central Tropical Africa -- Senegal [Roger & Malamaire 1937], Sierra Leone [Deighton 1927], Liberia [McKinney 1929, Strong & Shattuck 1930], French Guinea [Roger & Malamaire 1937], Ivory Coast [Hédin 1931, Pascalet 1932], Gold Coast [Miles 1935], Togo, Dahomey, Gabon, French Congo [Pascalet 1932], Nigeria [Golding 1935], Cameroon [Dufrénoy & Hédin 1929], Belgian Congo [Strong & Shattuck 1930, Kufferath & Ghesquière 1932], East Africa [Warburg 1894, Zimmermann 1906, Storey & Nichols 1938], Zanzibar [Briant & Johns 1940], Italian Somaliland [François 1937], Madagascar [Bouriquet 1932]; also Java [Muller 1931, Pascalet 1932], and Brasil [Silberschmidt 1938].

Host range:

EUPHORBIACEAE -- *Manihot utilissima (L.) Pohl. [M. esculenta Crantz](bitter cassava), *M. palmata var. aipi Pohl. [M. dulcis var. aipi (Pohl.) Pax] (sweet cassava) [Golding 1936b], *M. glaziovii Müll. Arg. (ceara rubber) [Deighton 1927, 1935, Dufrénoy & Hédin 1929, Kufferath & Ghesquière 1932, Golding 1936a].

Symptoms: In leaves, mosaic mottling of pale yellow, nearly white, or pale green, marked distortion and dwarfing; general stunting of the

plant [Storey & Nichols 1938]. Symptoms vary with the strain of the virus and with environment. Two clearly marked groups of strains are (1) severe yellow mosaics with distortion and stunting, and (2) mild green mosaics with less ill effects [Storey 1936a, b, Storey & Nichols 1938].

Means of transmission: Not by sap [Zimmermann 1906, Bouriquet 1932, Pascalet 1932, Silberschmidt 1938, Storey & Nichols 1938] but sap transfer is claimed by some workers [Hédin 1931, Kufferath & Ghesquière 1932, Lefevre 1935]. By grafting [Zimmermann 1906, Storey 1930, Deighton 1932, Bouriquet 1932, Pascalet 1932, Silberschmidt 1938, Storey & Nichols 1938]. Not through seed or soil [Zimmermann 1906, Hédin 1931, Bouriquet 1932, Deighton 1935, Lefevre 1935, Storey & Nichols 1938]. By white flies (Aleyrodidae) -- Bemisia sp. [Kufferath & Ghesquière 1932, Storey 1934, Golding 1935, 1936, Storey 1936b, 1938, Storey & Nichols 1938].

Properties: Not determined.

Remarks:

Inoculations into a cassava clon under uniform test conditions show that cassava mosaic virus may be segregated into two groups of strains, severe and mild. These groups can be further subdivided under these test conditions, but the sub-types are probably not separable in the field. Both severe and mild strains are transmitted by Bemisia sp. Infection with a mild strain fails to confer immunity from severe strains. Attempts to attenuate severe strains by heat treatments were without success. [Storey 1935, 1936a, b, 1938, 1940, Storey & Nichols 1938].

Kufferath & Ghesquière 1932 state, without presenting experimental evidence, that male and female adult white flies are vectors, nymphs and larvae are not, and that inoculation by insects takes place in immature leaves. Storey has shown in detail that Bemisia sp. can inoculate cassava only through immature leaves, less than one fourth grown, although this vector can maintain itself on mature leaves. Virus inoculated into young leaves does not pass out of such leaves until about 8 days have elapsed. These facts permitted the development of an efficient single-leaf cage technique. [Storey & Nichols 1938].

Ghesquière referred the vector to Bemisia mosaicivecta n. sp., and later to B. gossypiperda Misra & Lamba var. mosaicivectura. Golding assigned his insects to B. nigeriensis Corb. Storey's pure-line vector collections have been identified by different specialists as B. gossypiperda and Bemisia sp. near nigeriensis Corb. In view of the difficulties this group presents to systematists it remains in doubt whether one or several species of Bemisia transmit cassava mosaic [Storey & Nichols 1938].

Apparent resistance to cassava mosaic is reported by many workers [Dufrénoy & Hédin 1939, Bouriquet 1932, Miles 1935, Golding 1936, François 1937] and intensive breeding and testing is in progress at Amani with some promise of field resistance [Storey 1936b, 1938, 1939, 1940, 1941].

Literature:

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(MORUS) MULBERRY MOSAIC VIRUS

Technical name:

Synonyms:
Mulberry mosaic (virus) Tu 1932
Mulberry mosaic virus Ho & Li 1936
Mulberry virosis virus Endo & Kurasawa 1937
Mulberry dwarf virus Kawai 1939

Name of disease: Mulberry mosaic

Geographical distribution: Kwangtung, China [Tu 1932, Ho & Li 1936], Japan [Endo & Kurasawa 1937, Endo 1939, Kawai 1939], Puerto Rico [Cook 1931].

Host range:
MORACEAE -- *Morus alba L. (silkworm mulberry), *Morus spp. [Cook 1931]. Possibly also *Broussonetia papyrifera (L.) Vent. (paper mulberry) which shows similar symptoms in Kwangtung [Ho & Li 1936].

Symptoms: In leaves, mosaic mottling, puckering, reduction or suppression of the lamina, sometimes enations on the under surface. Stunting of the entire tree, sometimes rosetting, proliferation of lateral buds, and finally death.[Endo & Kurasawa 1937]. Intracellular bodies occur in epidermal and mesophyll cells [Endo & Kurasawa 1937, Kawai 1939].

Means of transmission: By grafting [Cook 1931]. By grafting, with symptoms after 2 weeks [Ho & Li 1936].

Properties: The virus remains virulent for 9 years in desiccated leaves [Endo 1939].

Literature:

Cook, M. T. New virus diseases in Porto Rico. Phytopath. 21: 124. 1931. (Abst.)

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(MUSA) ABACÁ BUNCHY TOP VIRUS

Technical names:

Musa virus 2 Smith 1937

Marmor abaca Holmes 1939

Synonym:

Abacá bunchy-top virus Ocfemia 1926

Name of disease: Abacá bunchy top

Geographical distribution: Philippine Islands.

Host range:

MUSACEAE -- *Musa textilis Née (abacá or Manila hemp).

Symptoms: In early stages, chlorotic areas on the blade of the youngest open leaf. When such a leaf is fully expanded the area near the midrib is darker green than normal, the margins paler, thinner, and curled upward. The main veins are yellowish and transparent. Dark green streaks, broken or continuous, also appear parallel with the veins in some varieties. In advanced stages new leaves are progressively narrower and shorter, curled upward at the margins. The margins are pale green to white, with irregular diffuse chlorotic streaks extending toward the midrib. The chlorotic areas sometimes break down and heart rot ensues under moist conditions. Shortening of the leaf sheaths produces a rosette in which the leaves appear to arise from a common level at the top of the pseudo stem. Plants are much stunted, rarely produce pseudo stems as much as a meter long, and do not fruit. [Ocfemia 1926, 1927, 1930, 1931, 1934].

Means of transmission: By the aphid Pentalonia nigronervosa Coq. [Ocfemia 1926], symptoms appearing after 18 to 28 days [Ocfemia 1930]. Not through soil, nor by sap [Ocfemia 1930]. Not by Aphis gossypii Glover or by Rhopalosiphum nymphaeae (L.) [Celino 1940].

Properties: Not determined.

Remarks:

Abacá bunchy top is restricted to abacá (Musa textilis) [Ocfemia 1934], and is not transmitted to bananas in nature or in experimental trials [Ocfemia & Buhay 1934]. The virus is therefore held to be distinct from banana bunchy top virus [Ocfemia 1940], although the two viruses have the same specific vector and many symptoms in common.

Abacá mosaic of the Philippines [Celino 1940, Celino & Ocfemia 1941], infectious chlorosis of banana in Australia [Magee 1940], and the similar disease of bananas in Brasil [Silberschmidt & Nobrega 1941] are all attributed to cucumber mosaic virus by these workers. These diseases are closely similar to each other, but curiously abacá mosaic is not transmitted to Philippine varieties of banana [Celino 1940]. Mosaic differs sharply from bunchy top in symptoms, host range, and vector relations. In the Cavendish banana bunchy top can be superimposed on mosaic [Magee 1940] and, in abacá, mosaic can be superimposed on bunchy top and vice versa [Celino 1940].

As few as 5 individuals of Pentalonia nigronervosa can transmit abacá bunchy top. The vector may acquire the virus in 12 hours' feeding, and transmit after a further interval of 24 to 48 hours on the test plant. Infective aphids do not transmit the virus to their offspring [Ocfemia 1934, Ocfemia & Buhay 1934].

Variety tests indicate a number of abacá varieties show partial resistance, while canton and pacol, two inferior fiber plants of the same genus, are immune to bunchy top [Youngberg 1928]. The Putian variety shows great promise of resistance, and is used in rehabilitation and breeding [Silayan 1940].

Literature:

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Wardlaw, C. W. Diseases of the banana and of the Manila-hemp plant. London 1935. p. 364-376.

Youngberg, S. Twenty-seventh Ann. Rept. Bur. Agr. Philippine Islands. Dec. 1927. p. 69-70. 1928

(MUSA) BANANA BUNCHY TOP VIRUS

Technical name:
Musa virus 1 Smith 1937

Synonyms:
Plantain bunchy-top (virus) Bryce 1921
Banana bunchy-top (virus) Darnell-Smith 1924
Banana bunchy-top virus Magee 1927
Plantain bunchy-top virus Hutson & Park 1930

Name of disease: Banana bunchy top.

Geographical distribution: Australia -- New South Wales, Queensland [Magee 1927]; Bonin Islands [Bryce 1921]; Ceylon [Bryce 1921]; Egypt [Fahmy 1924]; Ellice Islands [Magee 1927]; Fiji [Parham 1936].

Host range:

MUSACEAE -- Musa spp. including M. banksii F. Muell.,*M. cavendishii Lamb. (Cavendish banana), *M. sapientum L. (banana), M. ensete Gmel. M. fehi Vieill., M. paradisiaca L. (plantain), M. textilis Noé (abacá, Manila hemp) [Magee 1927, 1940b, Park 1930].

Symptoms: Narrow dark green lines, broken or continuous, along secondary veins near the leaf base, best seen from below by transmitted light, and later on midribs and petioles. Clearing of veins is more prominent than green streaking in Musa textilis, but much less so in Cavendish banana [Magee 1940b]. Leaves unfurl unevenly in the form of a funnel. Successive leaves become progressively smaller, stiff, brittle, upright, often ridged, with their margins uprolled and wavy,

chlorotic in contrast with darker green near the midrib. There is little growth in height after infection; leaves are close-packed at the top of the pseudo stem through failure of the leaf stalks to elongate. Fruit bunches fail to emerge from the pseudo stem, or emerge partly or wholly, bearing short, brittle, sweet fruits. Diseased suckers do not fruit. [Darnell-Smith 1924, Magee 1927, 1940b, Park 1930, Wardlaw 1935]

Correlated with dark green streaks in the leaves are pathological modifications in the phloem and surrounding tissues. The sieve tubes and companion cells are replaced by irregular thin-wall tissue, including some areas of obliteration and necrosis. The fiber sheath is greatly reduced or absent. Hyperplasia of the surrounding parenchyma results in small-cell tissue of high chloroplast content, producing the green streak symptom. Starch and crystalline material accumulate in this surrounding ground tissue. Clearing of veins is due to clear giant cells replacing the bundle sheath and spongy parenchyma [Magee 1940b].

Means of transmission: Not by sap. Not by extracts of the aphid vector. Not through soil. Not by grafting, the inserted eyes dying. By the aphid Pentalonia nigronervosa Coq., symptoms appearing after 23 days or longer [Magee 1927, 1940a, Hutson & Park 1930].

Properties: Not determined.

Remarks:

Banana bunchy top differs from infectious chlorosis or mosaic (due to cucumber mosaic virus) in many respects, and from abacá bunchy top in host range. (See remarks under abacá bunchy top virus).

In affected Cavendish banana, the initial stages of differentiation of young bundles are normal. Striking tissue modifications first begin to appear with the differentiation of sieve tubes, suggesting that sieve tubes provide the path of movement of the virus [Magee 1940b].

Transmission may be effected by winged or wingless adult forms of Pentalonia nigronervosa, and by each of the 4 nymphal stages preceding each of the adult forms. Adult aphids fed on diseased leaves as adults are less efficient vectors than are nymphs. The virus is not transmitted by adults to their viviparous progeny. Acquisition of the virus requires a minimum of 17 hours' feeding; not less than 1 1/2 to 2 hours' feeding on susceptible plants suffices for inoculation. Infective aphids retain the virus after 84 hours' starving on cotton wool, or after 13 days in daily transfers to healthy plants. Nymphal aphids retain the virus through their moults. There is a delay or "waiting period" in the vector, varying with the individual from a few hours to approximately 2 days [Magee 1927, 1940a].

The narrow host range of the virus, absence of wild host plants, and limited feeding range of the vector permitted effective control of banana bunchy top in Australia [Magee 1936].

Literature:

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Hutson, J. C., and M. Park. Investigation of the bunchy top disease of plantains in Ceylon. Trop. Agric. (Ceylon) 75: 127-140. 1930

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Wardlaw, C. W. Diseases of the banana and of the Manila hemp plant. London 1935. pp. 321-363

(PRUNUS) FLOWERING CHERRY BANDED-CHLOROSIS VIRUS

Technical names:
Marmor pallidolimbatus Zeller & Milbrath
Prunus virus 10 Zeller & Milbrath

Synonym:
Flowering cherry banded-chlorosis virus

Name of disease: Flowering cherry banded chlorosis

Geographical distribution: United States (Pacific Northwest).

Host range:
ROSACEAE -- *Prunus serrulata Lindl. (flowering cherry) vars. Amanogawa, Okochin, Temari; *P. avium L., mazzard.

Symptoms: In Prunus serrulata, ring and line patterns bounded by whitish or yellowish chlorotic bands 1 to 2 mm broad. Similar symptoms in sprouts from mazzard cherry stocks.

Means of transmission: By budding (successful even when buds fail).

Properties: Not determined.

Literature:

Zeller, S. M., and J. A. Milbrath. Banded chlorosis, a transmissible disease of cherry. Phytopath. 32: 634-635. 1942

(ROBINIA) LOCUST BROOMING VIRUS (supplement)

(See also Plant Disease Reptr. Supplement 150, p. 468, 1944)

Technical name:

Polycladus robiniae McKinney 1944

Remarks:

Designated as type species of the genus Polycladus.

Literature:

McKinney, H. H. Genera of the plant viruses. Jour. Washington Acad. Sci. 34: 139-154. 1944

(ROSA) ROSE MOSAIC (supplement)

(See also Plant Disease Reptr. Supplement 150, p. 470. 1944)

Literature:

Massey, L. M. Virus diseases of roses. American Rose Annual 1944: 151-154. 1944

(ROSA) ROSE STREAK (supplement)

(See also Plant Disease Reptr. Supplement 150, p. 471. 1944)

Literature:

Massey, L. M. Virus diseases of roses. American Rose Annual 1944: 151-154. 1944

(ROSA) ROSE WILT (supplement)

(See also Plant Disease Reptr. Supplement 150, p. 472)

Symptoms: In young shoots and petiole bases, necrosis in cortex, medullary rays, and phloem, with gum-like deposits, and intercellular cavities resulting from collapse of cells. Intracellular bodies in those leaves that do not abscise early. [Grieve 1942]

Means of transmission: By sap with difficulty; by budding in low percentage due to death of most buds; symptoms after 10 to 20 days [Grieve 1942].

Properties: Gives no precipitin reaction [Grieve 1942].

Remarks:
Grieve (1942) considers his virus and Gigante's probably the same despite minor symptom differences.

Literature:
Grieve, B. J. Further observations on rose wilt virus. Proc. Roy. Soc. Victoria n. s. 54: 229-241. 1942. (Cited previously, but not seen previously in the original)

(SANTALUM) SANDAL LEAF-CURL MOSAIC VIRUS

Technical name:
Marmor santali Holmes 1939
Santalum virus 2 Smith 1937

Synonym:
Sandal leaf-curl mosaic virus Rao 1932

Name of disease: Sandal leaf-curl mosaic

Host range:
SANTALACEAE -- *Santalum album L.

Symptoms: In early stages, conspicuous interveinal-mosaic mottling in full-grown leaves, marked drooping of leaves and twigs. In later stages leaves are curled, crinkled, mottled, dwarfed principally in length, thickened, brittle, and fall prematurely. Twigs soon die, lateral shoots are proliferated, nodes sometimes thickened by swelling and death of dormant buds. Normal flowers and abnormal fruits are developed on diseased branches.

Means of transmission: By ring-bark grafts, symptoms appearing after about 25 days.

Properties: Not determined.

Literature:
Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 94
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 201
Venkata Rao, M. G. A preliminary note on the leaf curl mosaic disease of sandal. Indian Forester 59: 772-777. 1933

(SANTALUM) SANDAL SPIKE VIRUS

Technical names:
Chlorogenus santali Holmes 1939
Santalum virus 1 Smith 1937

Synonyms:
Sandal spike disease virus Coleman 1917
Sandal spike rosette virus Venkata Rao & Iyengar 1934a
Sandal pendulous spike virus Venkata Rao & Iyengar 1934a
Santalum virus 1A Smith 1937

Name of disease: Sandal spike

Geographical distribution: Southern India (Coorg, Madras, Mysore).

Host range:
SANTALACEAE -- *Santalum album L. (a native forest tree of Southern India, parasitic on a wide range of host plants).

Symptoms: Shoots grow out stiff and straight, with short internodes and stiff erect leaves. New leaves become progressively smaller, narrower, and more pointed, appearing as little brush-like tufts at the ends of bare branches. Haustoria and root-ends die. Clusters of shoots sometimes develop from proliferation of lateral buds. Diseased twigs do not flower; recently invaded twigs may show phyllody of sepals, petals, etc. No recovery is known. Infected trees die in a few months to 2 or 3 years after symptoms appear. [Barber 1903, Butler 1903, Coleman 1917, Rangaswami & Griffith 1940].

Starch accumulates in parenchyma of leaves and twigs. In older leaves the chloroplasts disintegrate. Intracellular inclusions, round or oval, vacuolate, associated with nuclei or free are found singly or occasionally up to 6 in a cell in mature spiked leaves, but not in the growing point above the third pair of leaves [Narasimhan 1928, 1933].

Pendulous spike, described as a strain of spike [Venkata Rao & Iyengar 1934a] is characterized by long drooping leaf-bearing twigs, absence of clusters of shoots, larger and broader leaves than the common or rosette type, occasional sparse flowering, very slow death of haustoria and root-ends.

Means of transmission: Not by sap [Coleman 1917, Sreenivasaya 1930a]. By grafting and budding [Coleman 1917, Sreenivasaya & Naidu 1928, Sreenivasaya 1930a, Venkata Rao & Iyengar 1934b, Rangaswami & Griffith 1939a, 1940]. By haustorial contact between healthy and spiked sandal trees [Coleman 1923, Venkata Rao & Iyengar 1934b, Rangaswami & Griffith 1939b, 1940], but not when these parasitize a common host of another species [Rangaswami & Griffith 1939b, 1940]. By unspecified insects [Rangaswami & Sreenivasaya 1935, Sreenivasaya 1936, Rangaswami & Griffith 1940]. By Jassus indicus (Walk.) [Rangaswami & Griffith 1941]. Not through soil or seed [Rangaswami & Griffith 1940]. Symptoms after 1 to 19 months, usually after 4 1/2 to 7 months [Rangaswami & Griffith 1939b, 1940].

Properties: Fresh spiked-leaf tissue inserted under a bark flap induces infection [Sreenivasaya 1930a, Rangaswami & Griffith 1939a, 1940], but according to Venkata Rao & Iyengar (1934b) only when the cut petiole forms a union with the cut bark tissues. Spiked-leaf tissue remains infectious after 10 hours' leaching in distilled water, but not

after brief soaking in dilute arsenic solutions [Rangaswami & Griffith 1940] nor after fine pulping [Sreenivasaya 1930a].

Remarks:

Sandal is parasitic on a great range of host species, some of which tend to confer resistance to spike, others to render sandal particularly susceptible to the disease [Sreenivasaya 1933, Varadaraja Iyengar 1938b, Rangaswami & Griffith 1939a, 1940].

Spike-like diseases occur in nearly 40 other species of plants in the sandal-spike area, notably in Datura stramonium, Dodonaea viscosa, Stachytarpheta indica, Vinca rosea, and Zizyphus oenoplia [Coleman 1917, Venkata Rao 1935, Varadaraja Iyengar 1938b, Rangaswami & Griffith 1939b, 1940], but healthy sandal does not become spiked on haustorizing such diseased plants [Venkata Rao 1935] or when grafted with scions from such plants [Rangaswami & Griffith 1939b]. Coleman (1917) proved intraspecific graft transmission of spike-like diseases in Stachytarpheta and Zizyphus.

Defoliation or light pruning accelerates expression of symptoms in infected trees [Sreenivasaya 1930b, Rangaswami & Griffith 1940]. A high ratio of length to breadth in leaves, short petioles, and short and regular internodes are valuable criteria in diagnosing spike, and a low ratio of calcium to nitrogen is also considered a useful index of disease [Varadaraja Iyengar 1938a]. Extensive studies of the biochemistry and physiology of spike [Sastri 1936, Varadaraja Iyengar 1937, 1938a] show diseased tissues are higher in starch, in sugars, in total nitrogen, in tannins, and in diastatic activity, are more acid than normal tissues, and low in calcium.

Spike-like symptoms in sandal may result from mass feeding of insects, from association with unfavorable host plants, from the death of the host plant, etc. Essential criteria for diagnosis of spike are therefore defined as (1) expression of typical symptoms, (2) sub-transfer by grafting, and (3) death of the plant within a reasonable time [Rangaswami & Griffith 1940]. Earlier claims of transmission by the leafhopper Moonia albimaculata Dist., and by aphids [Dover & Appana 1934] fail to meet these criteria [Sreenivasaya 1934], but later tests with mixtures of insect species [Rangaswami & Sreenivasaya 1935, Sreenivasaya 1936, Rangaswami & Griffith 1940], and finally with cultures of Jassus indicus [Rangaswami & Griffith 1941] met all these requirements successfully.

Sandal spike virus does not pass where bark is ringed, hence does not move through xylem. The maximum observed rate of movement through tissues was 12 inches in 89 days [Venkata Rao & Iyengar 1934a]. Budded trees girdled just below the spike bud 16 days or less after budding did not develop spike, but those girdled 21 days or more after budding became spiked [Rangaswami & Griffith 1940]. In budding, patch-grafting, etc., some succesful unions failed to transmit spike, suggesting that the virus is not present in all buds or in all parts of the bark of spiked trees. Twig grafts, employing a larger mass of spiked tissue, transmitted the virus uniformly when union was effected [Venkata Rao & Iyengar 1934b].

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(SENECIO) CINERARIA MOSAIC VIRUS

Technical name:

Synonym:
Cineraria mosaic virus Jones 1944

Name of disease: Cineraria mosaic

Geographical distribution: United States (Washington) [Jones 1944]; Canada (?) [Dickson 1920].

Host range:
COMPOSITAE -- *Senecio cruentus (Mass.) DC. (cineraria)

Symptoms: In leaves of cineraria, vein-clearing and puckering of young leaves, followed by irregular light and dark green mottling, crinkling, and dwarfing.

Means of transmission: Through seed; by sap, symptoms after 20 to 24 days or longer; by Aphis marutae Oestlund.

Properties: Thermal inactivation point between 70° and 80° C. Active after aging in juice extract for 14 days, not after 100 days.

Remarks:
Cineraria streak virus, included in PDR Suppl. 150 (p. 474) is now considered to be a strain of tomato spotted-wilt virus and should be omitted.

Literature:
Washington Agricultural Experiment Station Annual Reports 49: 61. 1939; 50: 77. 1940; 51: 84. 1941; 52: 73-74. 1942

Dickson, B. T. A mosaic-like disease of cineraria. Ann. Rept. Quebec Soc. Prot. Plants 1920: 46-47. 1920
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STACHYTARPHETA MOSAIC VIRUS

Technical name:

Synonym:
Stachytarpheta mosaic virus

Name of disease: Stachytarpheta mosaic

Geographical distribution: Ceylon.

Host range:
VERBENACEAE -- *Stachytarpheta jamaicensis (L.) Vahl.

Symptoms: Irregular bright-yellow blotching in leaves.

Means of transmission: By grafting, symptoms after 16 to 22 days; not by sap.

Properties: Not determined.

Literature:
Loos, C. A. Some virus diseases of Stachytarpheta. Trop. Agric. (Ceylon) 98: 8-12. 1942

STACHYTARPHETA ROSETTE VIRUS

Technical name:

Synonym:
Stachytarpheta rosette virus

Name of disease: Stachytarpheta rosette

Geographical distribution: Ceylon.

Host range:
VERBENACEAE -- *Stachytarpheta jamaicensis (L.) Vahl.

Symptoms: Leaves dwarfed, crowded on short internodes, forming a rosette (based on one affected plant).

Means of transmission: By grafting, symptoms after 2 months (one transfer).

Properties: Not determined.

Literature:

Loos, C. A. Some virus diseases of Stachytarpheta. Tropical Agric. (Ceylon) 98: 8-12. 1942

STACHYTARPHETA SPIKE VIRUS

Technical name:

Synonym:
Stachytarpheta spike virus Coleman 1917

Name of disease: Stachytarpheta spike

Geographical distribution: India.

Host range:
VERBENACEAE -- *Stachytarpheta indica (L.) Vahl.

Symptoms: Similar to those of sandal spike. Deposition of starch in parenchyma. Phyllody is common.

Means of transmission: By grafting.

Properties: Not determined.

Remarks: See also sandal spike virus and Stachytarpheta rosette virus.

Literature:

Coleman, L. C. Spike disease of sandal. Dept. Agric. Mysore, Mycol. Ser. Bull. 3. 52 pp + 18 pls. 1917 (see p. 20, 44, pl.XVIII).

(THEOBROMA) CACAO RED-MOTTLE VIRUS

Technical name:

Synonym:
(Cacao) red mottle virus Posnette 1944

Name of disease: Cacao red-mottle

Geographical distribution: Trinidad.

Host range:
STERCULIACEAE -- *Theobroma cacao L.

Symptoms: In leaves, red pigment along the sides of some of the main veins; small cleared areas also along veins, forming discontinuous yellow patches; occasionally crinkling or a leaf-tip necrosis. Red mottling in young pods of some clons.

Means of transmission: By budding, symptoms appearing after 94 to 119 days.

Properties: Not inactivated in budwood by heating for 10 minutes at 50° C., or for 45 minutes at 43.4° C.

Literature:

Posnette, A. F. Virus diseases of cacao in Trinidad. Trop. Agric. (Trinidad) 21: 105-106. 1944

(THEOBROMA) CACAO SWOLLEN-SHOOT VIRUS

Technical name:

Synonym:
Cacao swollen-shoot virus Posnette 1940

Name of disease: Cacao swollen-shoot

Geographical distribution: Gold Coast (Africa).

Host range:
STERCULIACEAE -- *Theobroma cacao L.

Symptoms: In young leaves mosaic mottling usually in the form of a veinal network, sometimes also crinkling, marked dwarfing of leaves, or a leaf shedding. Pods mottled, sometimes dwarfed. Short internodes. Smooth elongate swellings in branch tips tapering gradually to constrictions. Die-back of branches and trunk. Root swellings. [Stephen 1937, Posnette 1941, 1944].

Means of transmission: By budding and grafting; symptoms appearing after about 3 months [Posnette 1940, Waters 1941]. By seed from dwarfed pods, all or none of the seeds from a pod being infected [Posnette 1941]. By the cacao psyllid Mesohomotoma tessmanni (Aulm)[Posnette 1941, 1943] and reportedly also by mealy bugs (Coccidae) and by an aphid (Toxoptera aurantii (Fonsc.) [Posnette 1943].

Properties: Not determined.

Remarks:
Two or more strains of swollen-shoot virus are recognized differing in virulence and in symptom expression [Posnette 1941, 1943, 1944]. Data supporting the reports of insect transmission have not yet been published.

Literature:

Posnette, A. F. Transmission of "swollen shoot" disease of cacao. Trop. Agriculture (Trinidad) 17: 98. 1940

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(Stephen, W. F.) A new disease of cacao in the Gold Coast. Trop. Agriculture (Trinidad) 14: 84. 1937

Waters, H. B. Report of the Department of Agriculture, Gold Coast, for the year 1940-41. 10 pp. 1941

(THEOBROMA) CACAO VEIN-CLEARING VIRUS

Technical name:

Synonym:
(Cacao) vein-clearing virus Posnette 1944

Name of disease: Cacao vein-clearing.

Geographical distribution: Trinidad

Host range:
STERCULIACEAE -- *Theobroma cacao L.

Symptoms: In leaves, pronounced vein-clearing, extending to the finer veins, producing a yellow network with some crinkling.

Means of transmission: By budding, symptoms appearing after 45 to 60 days or longer.

Properties: Not determined.

Literature:

Posnette, A. F. Virus diseases of cacao in Trinidad. Trop. Agriculture (Trinidad) 21: 105-106. 1944

(ULMUS) ELM PHLOEM-NECROSIS VIRUS (supplement)

(See also Plant Disease Reptr. Supplement 150, p. 482. 1944

Geographical distribution: United States (Ohio, Indiana, Illinois, West Virginia, Kentucky, Tennessee, Missouri, Mississippi.)*

Host range: *Ulmus americana L., perhaps *U. alata Michx., but apparently not other native or exotic elm species [McLean 1944a], thus negating the suggestion that U. fulva Michx. may be susceptible [Swingle 1942].

Symptoms: In diseased roots phloem degeneration follows maturation of primary sieve tubes, necrosis may appear in protophloem cells, hypertrophy in the cells surrounding mature sieve tubes, and hyperplasia in the procambium. In older diseased phloem of both root and stem,

* Also Kansas [C. M. Slagg, Plant Dis. Reptr. 28 (34): 1053. 1944.]

sieve tubes are almost completely destroyed, adjacent parenchyma undergoes hypertrophy and hyperplasia, and cavities may result from collapse of groups of such cells [McLean 1944a, b].

Literature:

McLean, D. M. An experimental and histological study of phloem necrosis, a virus disease of American elm. Ohio State Univ. Absts. Doct. Diss. 1943-1944: 93-98. 1944a

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ZIZYPHUS SPIKE VIRUS

Technical name:

Synonym:
Zizyphus spike virus Coleman 1917

Name of disease: Zizyphus spike

Geographical distribution: India

Host range:
RHAMNACEAE--*Zizyphus oenoplia Mill.

Symptoms: Leaves pale, much reduced in size; internodes shortened. Accumulation of starch in parenchyma of leaves and twigs. Death of fine root ends.

Means of transmission: By grafting [Coleman 1917]. Through seed [Sreenivasaya & Rangaswami]

Properties: Not determined.

Remarks:
See also sandal spike virus.

Literature:

Coleman, L. C. Spike disease of sandal. Dept. Agric. Mysore, Mycol. Ser. Bull. 3. 52 pp. + 18 pls. 1917. (See p. 19, 44, Pls. VIII, XVII).

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